

OSTROLENK, FABER, GERB & SOFFEN, LLP

Attorneys at Law

1180 Avenue of the Americas
New York, New York 10036-8403

(212) 382-0700

Telex
23 6925

Facsimile
(212) 382-0888

Cable
Ostrofaber New York

Express Mail #EL583738665US

Asst. Commissioner for Patents
Washington, DC 20231

OFGS File No. : P/3331-131
Inventor : Edward HOWORKA et al.
Title : ARCHITECTURE FOR AN ANONYMOUS TRADING SYSTEM

Enclosed herewith please find the following documents in the above-identified application for United States Letters Patent:

21 Pages of Specification including Abstract and Claims
12 Numbered Claims Calculated as 12 Claims for Fee Purposes, following Preliminary Amendment
6 Sheets of Drawing Containing Figures 1 to 6
xxx Declaration and Power of Attorney (unsigned)
--- Priority is Claimed under 35 U.S.C. §119:
Convention Date _____ for _____ Appln. S.N. _____
--- Certified Priority Application
--- Verified Statement Claiming Small Entity Status under 37 C.F.R. §1.27.
--- Assignment
xxx Return-Addressed Post Card

OFGS Check No. 95094, which includes the fee of \$690.00 calculated as follows:

Basic Filing Fee: \$ 690.00
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Total Filing Fees or
Total Filing Fee Reduced 50% for Small Entity:
Assignment Recording Fee: \$40
TOTAL Filing Fee and Assignment Recording Fee: \$ 690.00

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Respectfully submitted,

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Yvette Carr

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Signature

June 23, 2000

Date of Signature

William O. Gray, III
Registration No.: 30,944
OSTROLENK, FABER, GERB & SOFFEN, LLP
1180 Avenue of the Americas
New York, New York 10036-8403
Telephone: (212) 382-0700

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

New York, New York

Edward HOWORKA et al.

Date: June 23, 2000

Serial No.: To be Assigned

Group Art Unit: --

Filed: Filed Herewith

Examiner: --

For: ARCHITECTURE FOR AN ANONYMOUS TRADING SYSTEM

Asst. Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Preliminary to examination, please amend the above-identified application as follows:

IN THE CLAIMS:

Claim 3, line 1, delete "or 2".

Claim 4, lines 1-2, delete ", 2 or 3".

Claim 5, lines 1-2, change "any preceding claim" to --claim 1--.

Claim 6, lines 1-2, change "any preceding claim" to --claim 1--.

Claim 9, lines 1-2, delete "or 8".

Claim 10, lines 1-2, delete ", 8 or 9"/

Claim 12, lines 1-2, change "any preceding claim" to --claim 1--.

REMARKS

Some claims have been amended (without prejudice) for purposes of fee reduction.

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Yvette Carr

Name of Person Mailing Correspondence

Signature

June 23, 2000

Date of Signature

WOG:db/jg

Respectfully submitted,

William O. Gray, III

Registration No.: 30,944

OSTROLENK, FABER, GERB & SOFFEN, LLP

1180 Avenue of the Americas

New York, New York 10036-8403

Telephone: (212) 382-0700

ARCHITECTURE FOR ANONYMOUS TRADING SYSTEM**TECHNICAL FIELD**

5 The present invention relates to a computer trading system for providing an electronic broking service for tradable items such as foreign exchange and financial instruments generally. In particular, the invention relates to a computer trading system having a plurality of trader
10 terminals connected to a network for submission and matching of bids, offers, buy and sell orders.

BACKGROUND TO THE INVENTION

15 An anonymous trading system is known, for example, in EP-A-0,399,850, EP-A-0,406,026 and EP-A-0,411,748 which disclose an automated matching system for anonymous trading of foreign currencies (or other financial instruments). In this system, a single host computer
20 maintains a central database of all trading instruments available for trade, credit information and bids and offers which have been submitted by terminals connected to the host via a computer network. The host computer uses information in its central database to match bids and
25 offers and buy and sell orders based on matching criteria which include a counter party credit limit.

The counter party credit limits are set at each trading floor, and are stored at the host computer, which then
30 establishes a gross counter party credit limit for each possible pair of counter-parties. The gross counter party credit limit is the minimum amount of the remaining credit from a first party to a second party, and the second party to the first party. The various trader terminals
35 connected to the host computer maintain and display only a

restricted subset of the information available at the host computer, such as best bids and offers.

5 A problem was identified with this system in that the host computer only used the credit information to check that a deal could proceed after a potential match had been identified. A trader thus could not know whether he had credit with a potential counter party prior to attempting
10 to trade. This problem was identified and a solution provided in the system disclosed in US-A-5,375,055.

In the system disclosed in US-A-5,375,055 a credit matrix is derived and stored at a plurality of regional nodes of
15 a distributed network, with each regional node distributing market information to a set of trader terminals to which the regional node is connected via an access node. The regional node is known as a Market Distributor and provides dealable price information to the
20 trader terminals connected via the access node known as a Market Access Node. The actual matching of bids, offers, buy and sell commands is provided by separate nodes known as Arbitrators.

25 We have appreciated problems with both the first, host system and second, distributed system discussed above. In particular, we have appreciated that a computer trading system should be capable of handling message flow in a global environment in which traders may be on different
30 continents. In the host system, messages between trader terminals must travel unnecessarily large distances to reach the single, host computer. This is particularly the case because deals may often fail because traders attempt to "hit" displayed prices which are derived from quotes
35 submitted by traders with which they have no credit. In the second, distributed system the burden of message

traffic is reduced by pre-screening prices for credit compatibility. However, messages must still flow between Arbitrator nodes and Market Distributor nodes so that the trader's view of an available market and the actual market available for matching are synchronised.

We have particularly appreciated that trading in a global trading system is often localised between traders in a particular geographic region and that message flow can be reduced in a global system if designed to take this factor into account, whilst maintaining the possibility of trading between traders at any point on the network.

SUMMARY OF THE INVENTION

In a broad aspect, the invention provides a computer trading system for trading financial instruments comprising: a plurality of broker nodes each performing a broking function and together comprising a distributed network; and a plurality of trader terminals connected to the distributed network, wherein each of the broker nodes comprises: a store of quotes available for trading; means for deriving market views from the store of quotes; means for providing the market views to the trader terminals; and a matching facility for matching compatible quotes and orders submitted by the plurality of trader terminals.

The invention provides a significant advantage in that quotes and orders can be matched by the same broker nodes that provide the market views to the traders connected to the network. This ensures that the market views provided to traders are identical to the actual market available for trading. In addition, because there are a plurality of broker nodes the process of distributing and matching quotes and orders can occur at a plurality of physical locations so that traders using the system at those

different locations do not suffer time delays in the transit of messages to a single host computer, or between computers performing the separate functions of price distribution and order matching. The key advantages are thus that orders can be matched closer to the traders, deal execution and price updates are faster, market views may be customized and the use of multiple broker-trading agent connections increases performance benefits and redundancy.

These advantages occur for the following reasons. A hit submitted by a trader is sent to its nearest broker node. It is often the case that this broker node will be able to match the hit with a quote. This is because trading occurs in different geographic regions at different times, so that a market maker and a taker are likely to be physically located in the same trading region at any particular time. This statistical likelihood means that message flow, and hence required bandwidth, throughout the network can be reduced.

A system embodying the intention is such that each broker node comprises means for generating a message notifying other broker nodes of the existence of a quote submitted by one broker node. This distribution mechanism ensures that all broker nodes have an up-to-date store of all quotes available in the system.

Each broker node in the embodying system also comprises means for storing an identifier which identifies each broker node from which a message notifying the existence of each quote was received. This allows messages to be targeted to broker nodes from which a quote originates.

The broker nodes in the embodiment are arranged so that the store of quotes available for trading is modified at

each broker node in accordance with matches performed by the matching facility. This ensures that the list of quotes is kept up-to-date as soon as matches occur, which as previously described are often concentrated in one region at any one time.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the invention will now be described, by way of example only, and with reference to the accompanying figures in which:

- Figure 1: is an overview of a trading system embodying the invention;
- Figure 2: shows the flow of messages when a new quote is submitted in the system;
- Figure 3: depicts the production of a market view to traders;
- Figure 4: shows the flow of messages when a trader submits a buy or sell order;
- Figure 5: shows the flow of messages to update broker nodes following a buy or sell order; and
- Figure 6: shows the deal execution process.

DESCRIPTION OF A PREFERRED EMBODIMENT

The purpose of the embodying system is to allow traders to enter quotes and orders which are then matched within the system. The system provides a platform for trading at least the following instruments: FX Spot, FRA, and

Forwards and also FX Forwards, CFDs, short-dated government and/or central bank paper, commercial bills, CDs, inter-bank deposits, commercial paper, repos, interest-rate futures, swaps, options and a miscellany of tailor-made variants on these basic products. These are all referred to as financial instruments.

Traders at trader terminals submit quotes and hits which are then passed on to each of a plurality of broker nodes throughout the system. A quote is a bid or offer order submitted by a trader to "make a market" and is distributed to other traders as part of a market view. Quotes are thus orders visible to other traders. A hit is a buy or sell submitted by a trader wishing to create a deal on the basis of a price displayed on his market view derived from one or more quotes. Hits are orders which are invisible to other traders.

The computer trading system of Figure 1 comprises a plurality of trading agents 10 each connected to at least one of a plurality of broker nodes 12. Each trading agent is the means by which the trader terminals access the trading system.

Trader terminals (not shown) may be workstations or other computer terminals configured to submit quotes and orders (usually through use of a specialised key pad) and to display market view data, including price and amount available, for financial instruments to be traded. Traders are typically grouped as part of a financial institution, such as a bank, which arranges traders as part of a trading floor. A trading floor is a group of traders under common control of a trading floor administrator who allocates credit lines for the trading floor against other trading floors. The market view for a

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in a structure called a Clique Tree which enables faster communications routing, following very specific but simple rules. The Clique Tree is a network structure where individual nodes are grouped into Cliques, and the Cliques are then arranged into a tree structure. Each Broker can be linked logically to a number of Brokers, which are referred to as its neighbor Brokers. Communication between Brokers is on an equal level, with no "up" or "down" direction in the network.

While Trading Agents must be connected to at least one Broker node, they themselves are not members of the Clique Tree, but remain outside the structure. A Trading Agent connected to multiple Broker nodes will receive multiple sets of market prices. Even though the price information from different Broker nodes can be substantially the same, the information may be received at different intervals. A Trading Agent will send a given trading order to only one Broker node.

The term Broker node is used to describe a computer arranged as a physical or logical node in a computer network providing a broking function. The basic broking function is the storing of quotes, providing the quotes to traders in the form of a market view and matching quotes and orders. The Broker nodes in the described embodiment also perform further functions, but these are not essential features of what is defined as a Broker node.

The Broker nodes are equal to each other, and perform the same functions. The arrangement of the network or their position in it is transparent to the broker nodes. They only need to know about their neighbors. Each Broker node has: knowledge of all orders in the market, and is able to match orders as soon as they are submitted. As a consequence of the fact that each Broker node maintains a

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information from a trader workstation that a trader has issued a bid or offer. The Trading Agent then starts the quote submission process. When the Trading Agent receives the quote information from the trader workstation, it will

5 create and maintain a context for the quote. It will then send a Quote Submit message to the Broker node that it is connected to. The Broker node will validate the quote and accept it if valid. This first Broker node that receives the quote becomes the "owner" Broker node for this quote.

10 In example shown in Figure 2 this is Broker node 5. This is the only Broker node that can commit the quote to a deal. The Broker node will create a context or "quote object" and sort it into its queue for the correct tradable instrument.

15 After the quote is placed into its queue, the owner Broker node will then distribute the quote throughout the network by sending QuoteAvailable messages to other Broker nodes. In this example, Broker node 5 sends the QuoteAvailable

20 message to Broker nodes 2 and 6. As each Broker node receives the message, it creates a context (quote object) and sorts it into its queue (order book). It notes in the context which Broker node had sent it the message. After placing it into the queue, the Broker node then sends the

25 QuoteAvailable message on, using broadcast routing rules, to all neighbors in other cliques. Therefore, Broker node 2 sends it to 1, 3 and 4. Broker node 4 then sends it to Broker node 7. At this point, all Broker nodes know about the quote, and update their order books accordingly.

30 The broadcast routing rules are applied to ensure that network traffic is handled in an efficient manner and to reduce any duplication of message flow.

35 The broadcast rules are:

1. The Broker node originating information will send it to all of its neighbour Broker nodes.
2. A Broker node receiving the information will send it to all of its neighbour Broker nodes except those in the same clique as the Broker node that sent the information.
3. If a message contains persistent information, such as a quote, the information will be stored with the identifier of the Broker node from which the information was received.

Note that these rules refer to the information, not the message that contains it. For example, information about a quote may be sent to one Broker node in a ProposeDeal message and to another Broker node in a MarketUpdate message. However, the same information is sent to both Broker nodes, and so that above rules apply.

Price distribution is the process of providing market information to the traders at the trader terminals. This information is created by the Brokers nodes and sent to the Trading Agents for distribution to the traders. This process is shown in Figure 3.

Each Broker node will examine its queue of quotes (order book) and calculate a view of the market for each Trading Agent connected to it. This view is built specifically for the trading floor that the agent represents. Views may be different based on credit or other factors. The exact process for determining a market view will vary based on the trading instrument. The view information is sent to the Trading Agent in a MarketView message.

Hitting a quote is the basic process of creating a deal between two traders. A hit from one trader is matched to a quote from another trader. This process is shown in the figure 4. The Trading Agent of the trader terminal hitting a price shown on his market view display sends a HitSubmit message to the Broker node. This message targets a price, not a specific quote. The Broker node will scan its queue and find the first quote in the queue that can be matched with the hit. The matching rules may vary based on the trading instrument.

When the hit is matched to a quote, the Broker node will modify its context for the quote, moving the amount matched from "available" to "reserved pending deal". This will prevent the same amount of the quote to be matched with another hit. The Broker node will then send a ProposeDeal message to the Broker node from which it received the quote. This message will target the specific quote. In this example, Broker 7 will send the message to Broker 4.

As each Broker node receives the ProposeDeal message, it checks the quote in its queue. If the amount of the proposed deal is still available in the queue, the Broker node performs a similar process as the matching Broker node. The amount of the proposed deal is moved from "available" to "reserved pending deal". The ProposeDeal message is then sent to the Broker node from which it received the quote. In the example, Broker node 4 sends it to Broker node 2. Broker node 2 will then send it to Broker node 5.

The routing of a ProposeDeal message follows targeted routing rules. Targeted routing is used to deliver information to a specific Broker node. Since knowledge of specific Broker nodes is not built into the system, the

target is not a specific Broker node, but is the Broker node from which the information originated. For example, a message is not sent to "Broker node 714", but is sent as to "the Broker node originating quote 42". The targeted rules are:

1. A Broker node originating a message about a specific piece of information, will send the message to the Broker node from which it received the original information.
2. A Broker node receiving a message about a specific piece of information that it did not originate, will send the message to the Broker node from which it received the original information.

The message will thus follow the path of the original information back to its source. In the example this is from Broker node 7, to Broker node 5, via Broker nodes 2 and 4 direct.

When the Broker node that originally created the quote receives the ProposeDeal message, it performs the same checks and amount reservation as the other brokers. Since this Broker node owns the quote, it has the authority to commit the quote to a deal. The ProposeDeal message represents the authority to commit the hit to the deal. The Broker node will then initiate the deal process by sending a HitAmount message to the Trading Agent that submitted the quote. The deal execution process is described later.

As the deal matching process takes place, it is necessary that the list of quotes maintained at each Broker node be

keep up to date. This is accomplished by each Broker node notifying others when it makes a change to a quote, as shown in figure 5.

- 5 As each Broker node changes a quote in its queue, it notifies all neighbor Broker nodes except those in the clique from which it received the change. In the example above, Broker node 4 received notice of a change in a quote from Broker node 7 in a ProposeDeal message. It
- 10 notifies Broker node 2 by sending the ProposeDeal message. Broker node 4 must now notify Broker nodes 1 and 3. This is done by sending a MarketUpdate message to these Broker nodes.
- 15 Following the normal routing rules, the information about the quote is distributed to each Broker node in the network. Any Broker node receiving the MarketUpdate message will pass it to all neighbors not in the clique from which it is received. Note that a Broker node sending
- 20 a ProposeDeal message should not also send a MarketUpdate message to the same Broker node. This would result in duplicate information being received and the deal amount being reserved twice.
- 25 The deal execution process itself is not central to the present invention, but will now be described for completeness. When the deal matching process is completed, as described above, the deal execution process begins. This process completes the deal and commits the traders to
- 30 a deal. The process is shown in Figure 6. As matches are made and deals initiated, information is made available for traders. This information can be used to inform a trader that a deal is pending. Any given trading application can decide if the trader should be informed.
- 35 In any case, the information is available.

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Agent completes the deal execution process. This part of the process takes place when the Agent receives the DealStatusMaker message from the maker. If the message shows a valid deal, the process continues.

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The taker's Trading Agent will next check for available credit with the counterparty in a similar manner as the maker. The credit check may allow the deal, reduce the amount of the deal or disallow the deal. The Agent will then reduce the available credit by the amount needed for the deal. This reduction in available credit may affect future deals. The taker's Trading Agent will now log the deal to its disk. As soon as the information is committed to persistent storage, the deal is done. Any checks on the deal status will now show a binding deal. The agent will now notify the trader, print a deal ticket and perform any other post deal processing. At this point, the deal is done but the maker doesn't know yet. As soon as the deal is done, the taker's Trading Agent will notify the maker by sending a DealStatusTaker message to its Broker node. This message is targeted to the quote and will be routed to the maker's Agent.

The DealStatusTaker message contains final information about the deal, and therefore the final changes to the quote. This information is used by the network Broker nodes and the Trading Agent. As the DealStatusTaker message is routed through the Broker nodes, each routing Broker node will use the information to update its quote context. The amount of the deal is moved from "reserved" to "complete". The portion not done is moved from "reserved" to "available" if the quote is still active. It will then notify other Broker nodes of the changes and of the deal by sending a MarketUpdate message to all other Broker nodes using network routing rules.

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CLAIMS

1. A computer trading system for trading fungible instruments, comprising:
- 5 - a communications network for distributing electronic messages;
 - a plurality of order input devices connected to the communications network each for generating electronic order messages; and
 - 10 - a plurality of Broker nodes connected to the communications network, each Broker node arranged to perform a broking function including matching orders and providing market views to trader terminals each Broker node comprising:
 - 15 - a store of orders available for trading in the system;
 - means for deriving a market view from the store of orders;
 - 20 - means for providing the market view to at least one of the plurality of trader terminals; and
 - a matching facility for matching compatible orders submitted by the plurality of order input devices.
- 25
2. A computer trading system according to claim 1, wherein the store of orders holds orders submitted to the trading system from order input devices via other Broker nodes.
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3. A computer trading system according to claim 1 or 2, wherein each Broker node further comprises means for sending orders to other Broker nodes connected to the communications network.
- 35

8. A computer trading system according to claim 7,
wherein each Broker node comprises means for
generating a message notifying other Broker nodes in
the network of the existence of an order submitted by
one Broker node.
9. A computer trading system according to claims 7 or
8, wherein each Broker node comprises means for
storing an identifier which identifies each Broker
node from which a message notifying the existence
of each order was received.
10. A computer trading system according to claims 7, 8
or 9, wherein the means for providing the market
view to at least one of the plurality of trader
terminals comprises means for deriving dealable
prices from the orders in the store of orders.
11. A computer trading system according to claim 10,
wherein the dealable prices are determined from the
subset of orders corresponding to traders with
which credit is available on a bilateral basis.
12. A computer trading system according to any
preceding claim, wherein the store of orders
available for trading is modified at each broker
node in accordance with matches performed by the
matching facility.

Broking Platform Fundamental Architecture

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Figure 1

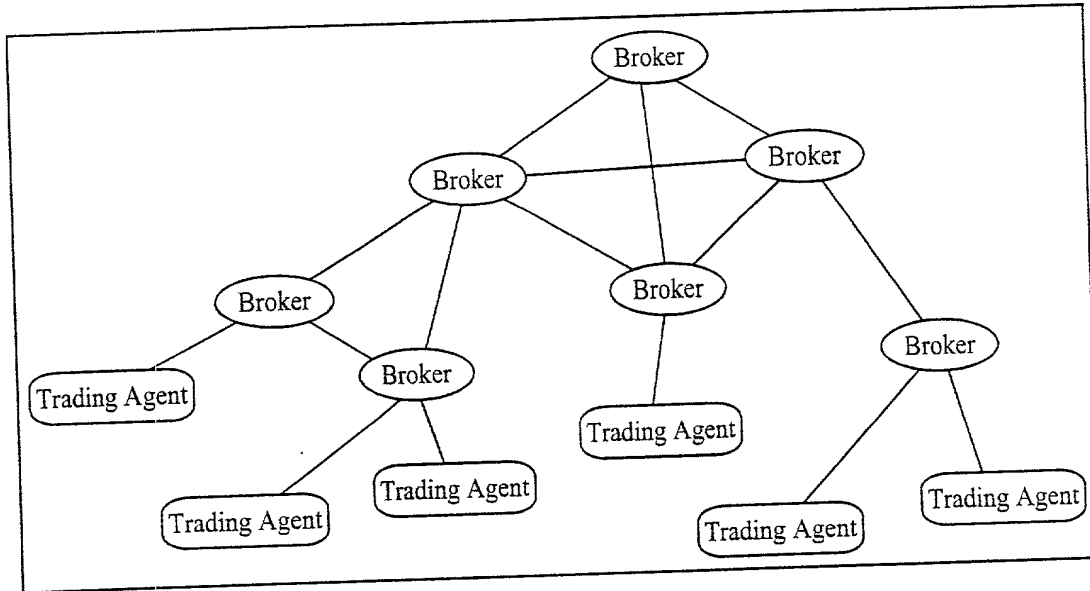
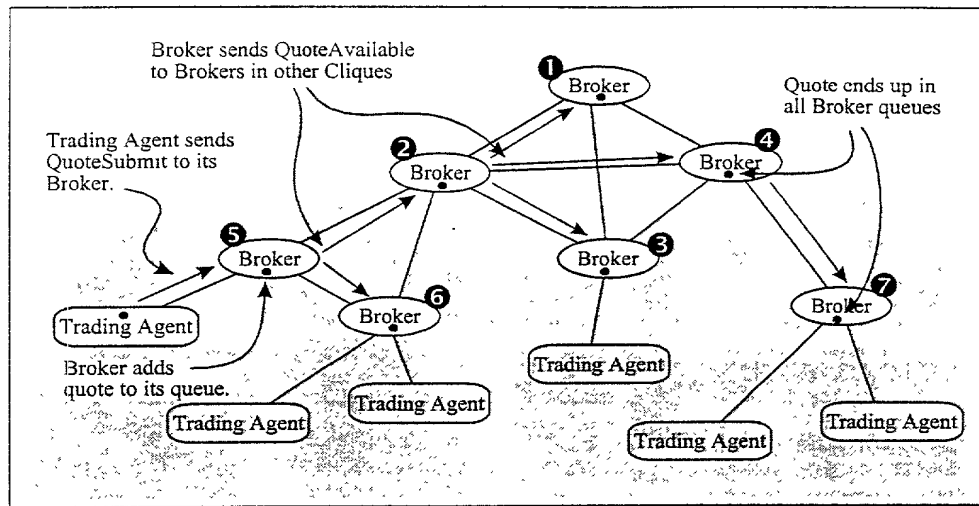
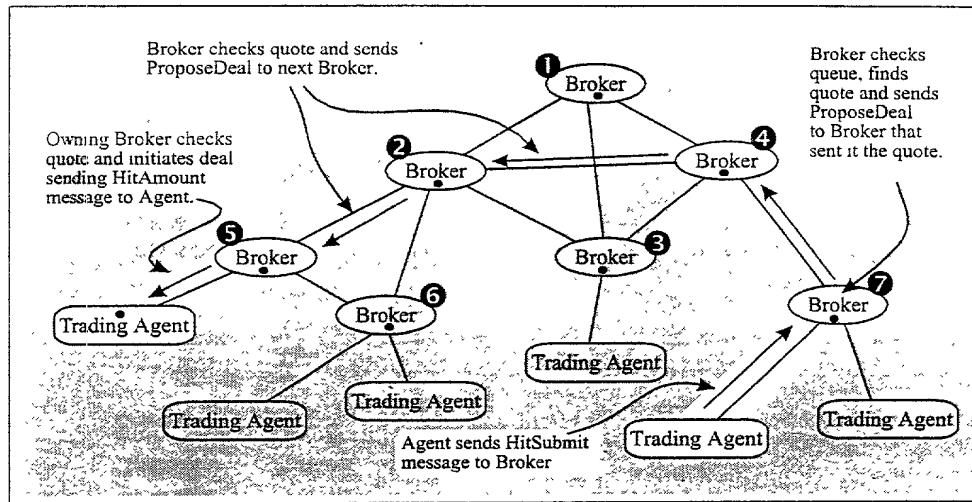
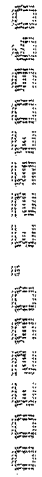
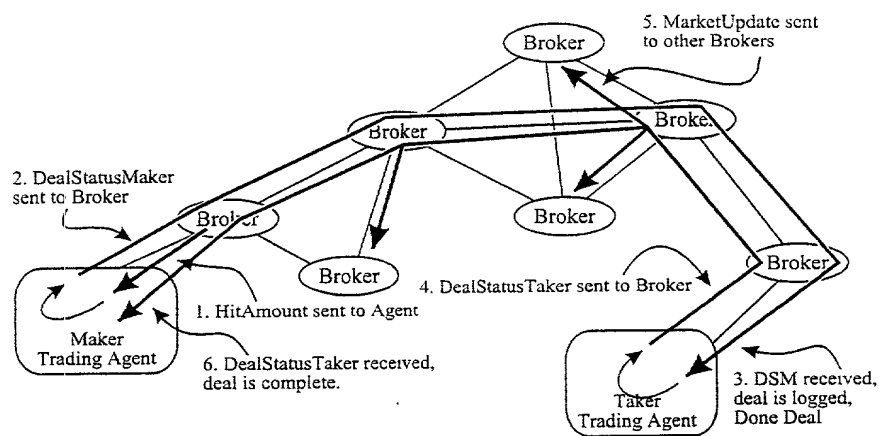


Figure 2



[illegible]

[illegible]

[illegible]

As a below named inventor, I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that I verily believe that I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

ARCHITECTURE FOR AN ANONYMOUS TRADING SYSTEM

the specification of which is attached hereto, unless the following box is checked:

☐ was filed on _____ as United States patent Application Number or PCT International patent application number _____ and was amended on _____ (if any).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information known to be material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim priority benefits under Title 35, United States Code §119 of any foreign application(s) for patent or inventor's certificate or United States provisional application(s) listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign or Provisional Application(s)

COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 U.S.C. 119
			YES ___ NO ___
			YES ___ NO ___
			YES ___ NO ___

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

UNITED STATES APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS (patented, pending, abandoned)

I hereby appoint customer no. 2352 OSTROLENK, FABER, GERB & SOFFEN, LLP, and the members of the firm, Samuel H. Weiner - Reg. No. 18,510; Jerome M. Berliner - Reg. No. 18,653; Robert C. Faber - Reg. No. 24,322; Edward A. Meilman - Reg. No. 24,735; Stanley H. Lieberstein - Reg. No. 22,400; Steven I. Weisburd - Reg. No. 27,409; Max Moskowitz - Reg. No. 30,576; Stephen A. Soffen - Reg. No. 31,063; James A. Finder - Reg. No. 30,173; William O. Gray, III - Reg. No. 30,944; Louis C. Dujmich - Reg. No. 30,625 and Douglas A. Miro - Reg. No. 31,643, as attorneys with full power of substitution and revocation to prosecute this application, to transact all business in the Patent & Trademark Office connected therewith and to receive all correspondence.

SEND CORRESPONDENCE TO: **OSTROLENK, FABER, GERB & SOFFEN, LLP** DIRECT TELEPHONE CALLS TO:
1180 AVENUE OF THE AMERICAS (212) 382-0700
NEW YORK, NEW YORK 10036-8403
CUSTOMER NO 2352

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

FULL NAME OF SOLE OR FIRST INVENTOR Edward HOWORKA	INVENTOR'S SIGNATURE	DATE
RESIDENCE (City and either State or Foreign Country) Morris Plains, New Jersey		COUNTRY OF CITIZENSHIP
POST OFFICE ADDRESS 2043 Gates Court, Morris Plains, New Jersey 07950		
FULL NAME OF SECOND JOINT INVENTOR (IF ANY) Andrew FORAY	INVENTOR'S SIGNATURE	DATE
RESIDENCE (City and either State or Foreign Country) Wayne, New Jersey		COUNTRY OF CITIZENSHIP
POST OFFICE ADDRESS 21 New Street, Wayne, New Jersey 07470		
FULL NAME OF THIRD JOINT INVENTOR (IF ANY)	INVENTOR'S SIGNATURE	DATE
RESIDENCE (City and either State or Foreign Country)		COUNTRY OF CITIZENSHIP
POST OFFICE ADDRESS		

☐ CONTINUED ON PAGE 2